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Hirosawa et al.

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[54] **CONSOLE APPARATUS FOR INFORMATION PROCESSING SYSTEM**

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[21] Appl. No.: **08/824,487**

[22] Filed: **Mar. 27, 1997**

Related U.S. Application Data

[63] Continuation of application No. 07/942,811, Sep. 10, 1992, Pat. No. 5,687,313, which is a continuation-in-part of application No. 07/848,930, Mar. 10, 1992, abandoned.

[30] **Foreign Application Priority Data**

Mar. 14, 1991 [JP] Japan 3-049344
Sep. 13, 1991 [JP] Japan 3-234553

[51] **Int. Cl.**[6] **G06T 1/00**

[52] **U.S. Cl.** **395/200.54**; 340/384.1; 345/117; 345/340; 345/344; 345/347

[58] **Field of Search** 395/183.22, 200.54; 340/384.1; 345/117, 340, 344, 347

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5,687,313	11/1997	Hirosawa et al.	395/200.54

Primary Examiner—Joseph H. Feild
Attorney, Agent, or Firm—Antonelli, Terry Stout & Kraus, LLP

[57] **ABSTRACT**

A console apparatus for an information processing system having a plurality of information processing apparatuses, includes a memory for storing messages received from the plurality of information processing apparatuses at a plurality of storage areas provided in correspondence with the plurality of information processing apparatuses; a message analyzing unit for analyzing the received messages to detect, as the states of the plurality of information processing apparatuses, a reply request by the information processing apparatus to an operator and an error occurrence of the information processing apparatus; and a display unit having a shared display screen for displaying the messages stored in the memory on the shared display screen at areas corresponding to the storage areas and for displaying among the states detected by the message analyzing unit the state of at least one information processing apparatus on the shared display screen so as to allow a recognition of the state at a glance.

7 Claims, 12 Drawing Sheets

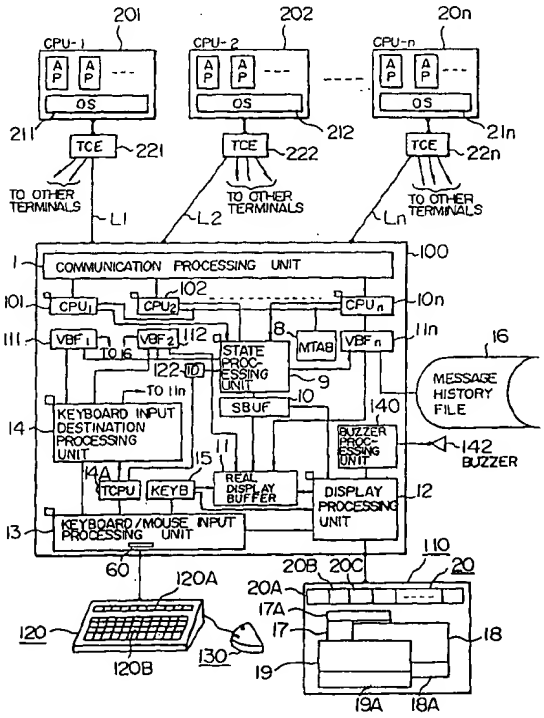

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FIG. 1

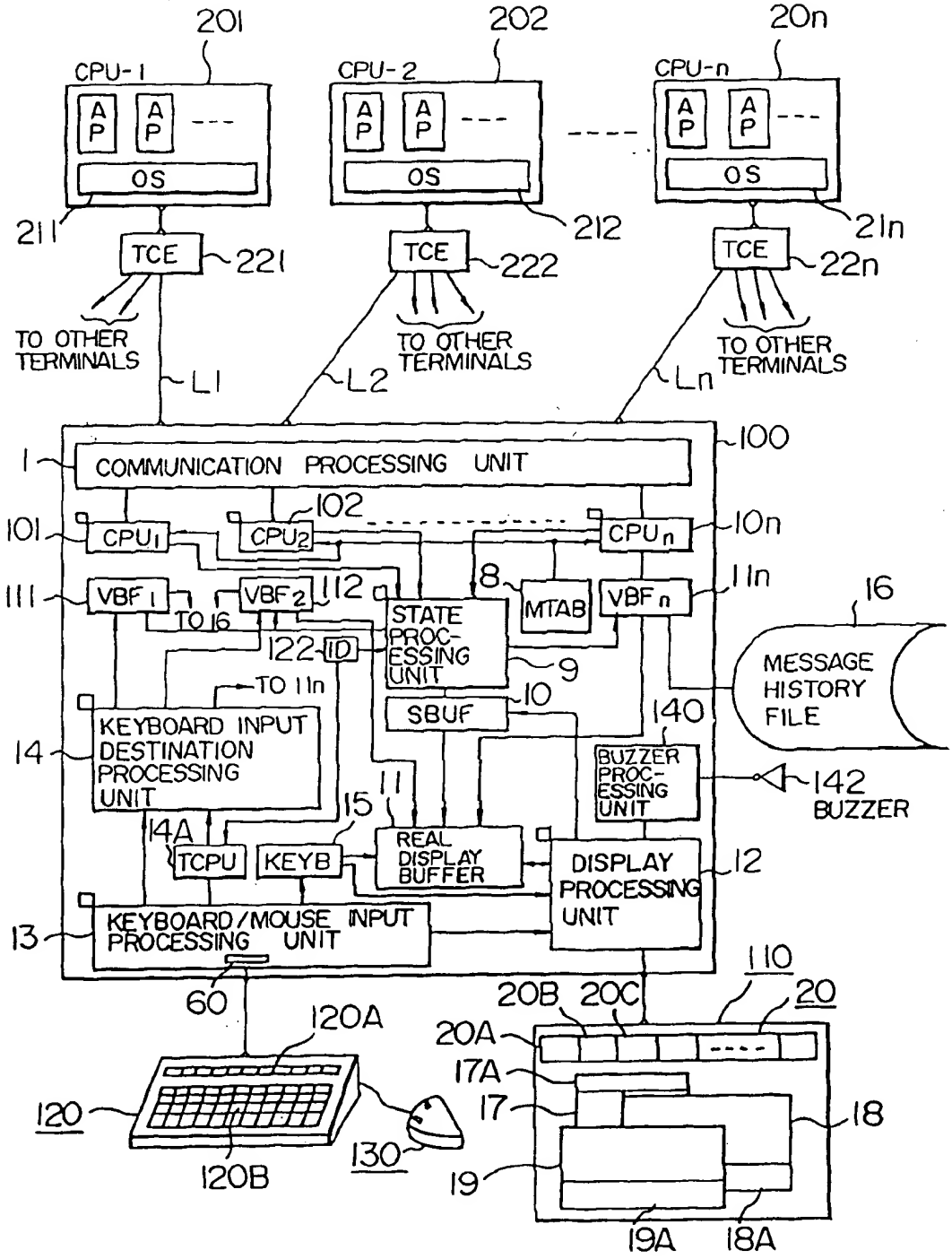

201
202
20n
CPU-1
CPU-2
CPU-n
AP
OS
211
212
21n
TCE
221
222
22n
TO OTHER TERMINALS
L1
L2
Ln
100
1
COMMUNICATION PROCESSING UNIT
101
CPU1
CPU2
CPUn
10n
102
111
VBF1
VBF2
VBFn
11n
112
TO 16
122
ID
8
MTAB
STATE PROC-ESSING UNIT
9
16
MESSAGE HISTORY FILE
TO 11n
SBUF
10
140
14
KEYBOARD INPUT DESTINATION PROCESSING UNIT
BUZZER PROC-ESSING UNIT
142
BUZZER
14A
15
11
TCPU
KEYB
REAL DISPLAY BUFFER
DISPLAY PROCESSING UNIT
12
13
KEYBOARD/MOUSE INPUT PROCESSING UNIT
60
110
20B
20C
20
120A
20A
17A
17
18
120
130
19
120B
19A
18A

FIG. 2

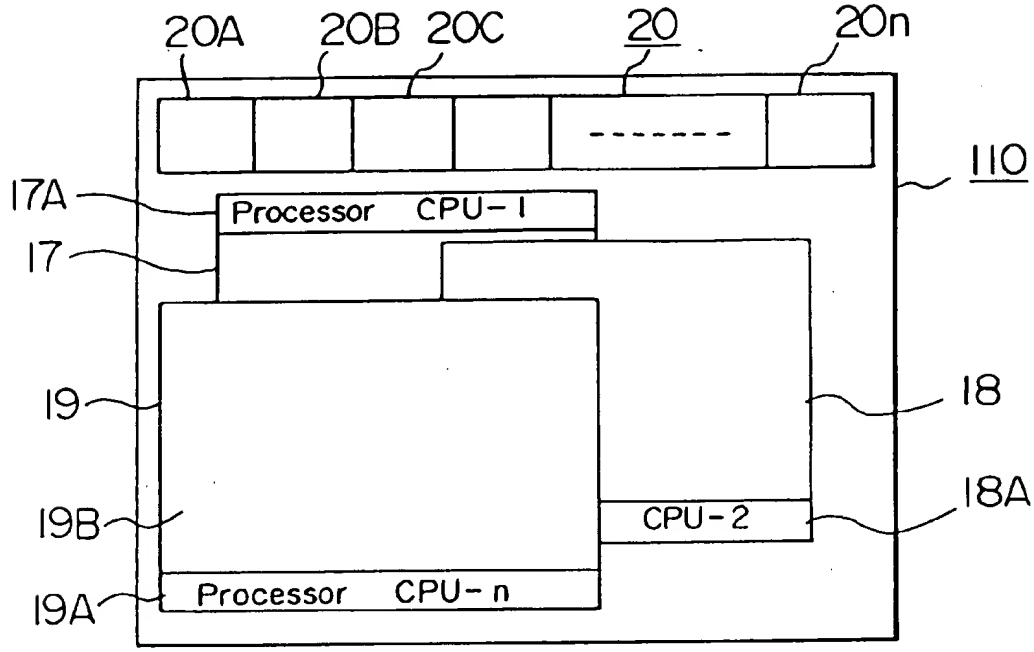

20A
20B
20C
20
20n
110
17A
Processor CPU-1
17
19
18
19B
CPU-2
18A
19A
Processor CPU-n

FIG. 3

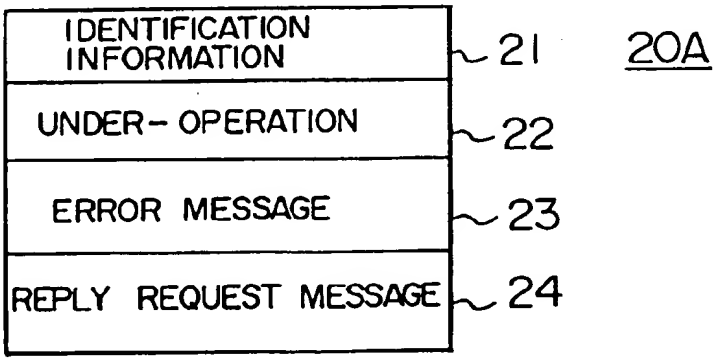

IDENTIFICATION INFORMATION
21
20A
UNDER-OPERATION
22
ERROR MESSAGE
23
REPLY REQUEST MESSAGE
24

FIG. 4

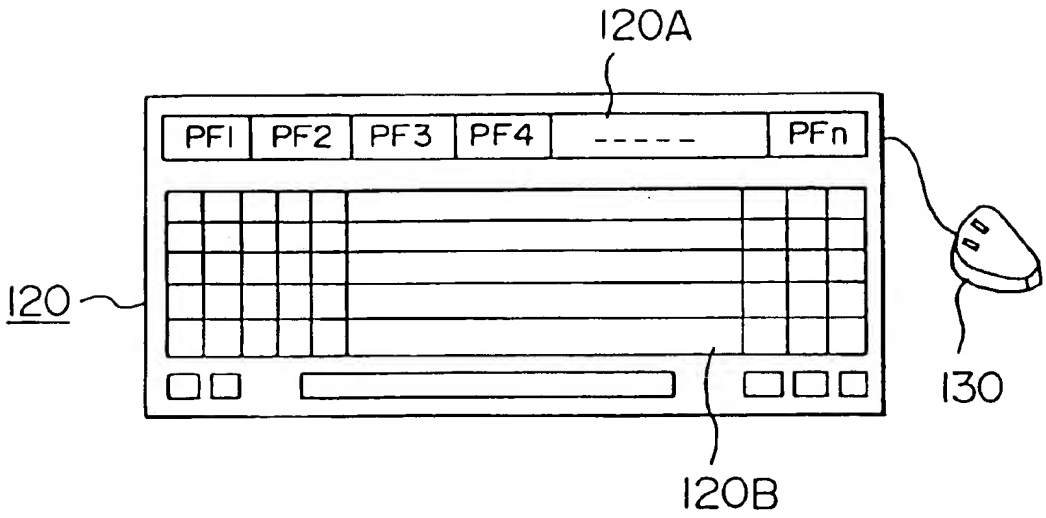


FIG. 5

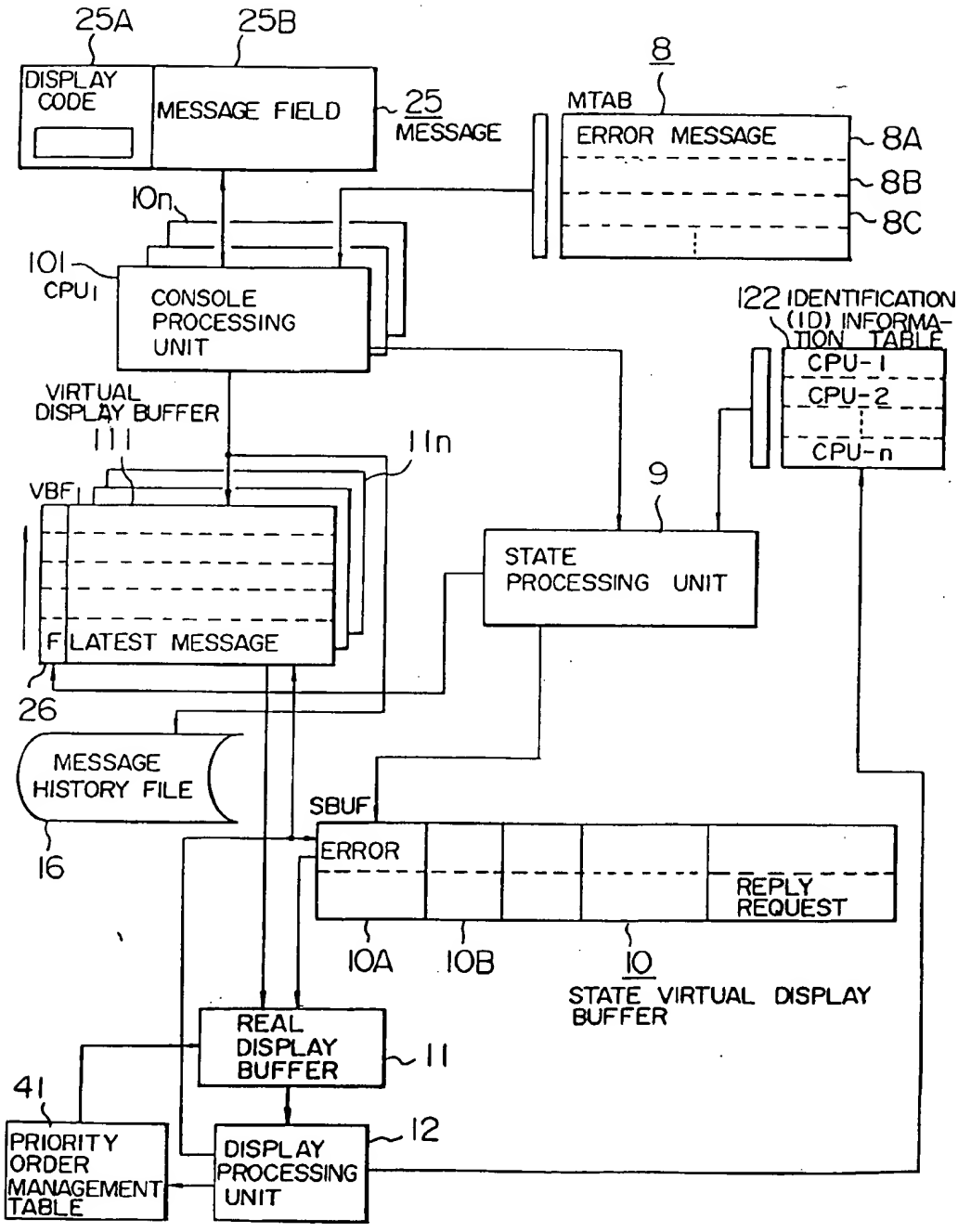

25A
25B
DISPLAY CODE
MESSAGE FIELD
25 MESSAGE
8
MTAB
ERROR MESSAGE
8A
8B
8C
10n
101 CPU1
CONSOLE PROCESSING UNIT
122 IDENTIFICATION (ID) INFORMATION TABLE
CPU-1
CPU-2
CPU-n
VIRTUAL DISPLAY BUFFER
111
11n
9
VBF1
STATE PROCESSING UNIT
LATEST MESSAGE
26
MESSAGE HISTORY FILE
16
SBUF
ERROR
REPLY REQUEST
10A
10B
10
STATE VIRTUAL DISPLAY BUFFER
REAL DISPLAY BUFFER
11
41
12
PRIORITY ORDER MANAGEMENT TABLE
DISPLAY PROCESSING UNIT

FIG. 6

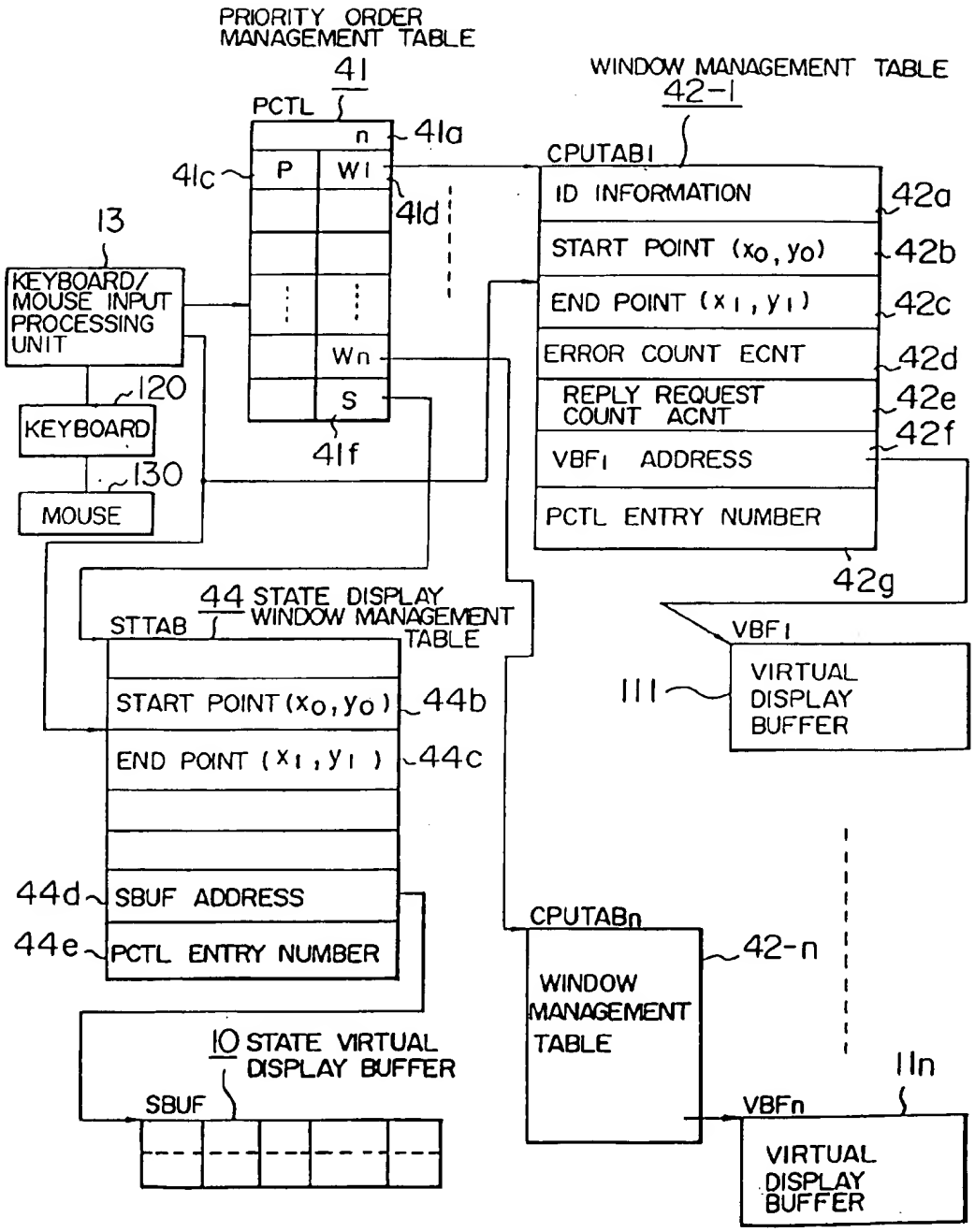

PRIORITY ORDER MANAGEMENT TABLE
41
PCTL
n
41a
P
W1
41c
41d
Wn
S
41f
13
KEYBOARD/ MOUSE INPUT PROCESSING UNIT
120
KEYBOARD
130
MOUSE
WINDOW MANAGEMENT TABLE
42-1
CPUTAB1
ID INFORMATION
42a
START POINT (xo, yo)
42b
END POINT (x1, y1)
42c
ERROR COUNT ECNT
42d
REPLY REQUEST COUNT ACNT
42e
VBF1 ADDRESS
42f
PCTL ENTRY NUMBER
42g
44 STATE DISPLAY WINDOW MANAGEMENT TABLE
STTAB
START POINT (xo, yo)
44b
END POINT (x1, y1)
44c
44d
SBUF ADDRESS
44e
PCTL ENTRY NUMBER
VBF1
111
VIRTUAL DISPLAY BUFFER
CPUTABn
42-n
WINDOW MANAGEMENT TABLE
10 STATE VIRTUAL DISPLAY BUFFER
SBUF
11n
VBFn
VIRTUAL DISPLAY BUFFER

FIG. 7

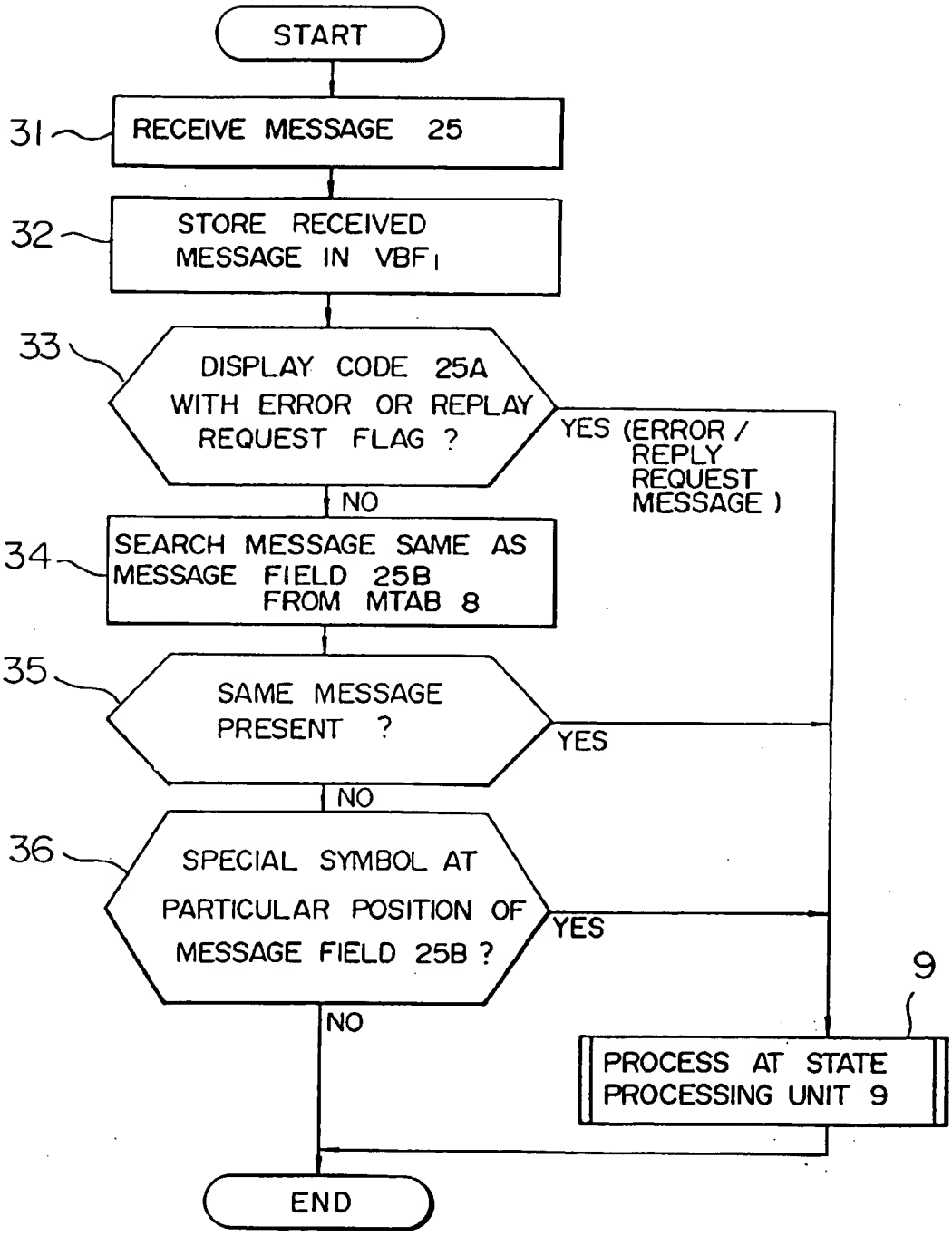

START
31
RECEIVE MESSAGE 25
32
STORE RECEIVED MESSAGE IN VBF1
33
DISPLAY CODE 25A WITH ERROR OR REPLAY REQUEST FLAG ?
YES (ERROR / REPLY REQUEST MESSAGE)
NO
34
SEARCH MESSAGE SAME AS MESSAGE FIELD 25B FROM MTAB 8
35
SAME MESSAGE PRESENT ?
YES
NO
36
SPECIAL SYMBOL AT PARTICULAR POSITION OF MESSAGE FIELD 25B ?
YES
NO
9
PROCESS AT STATE PROCESSING UNIT 9
END

FIG. 8

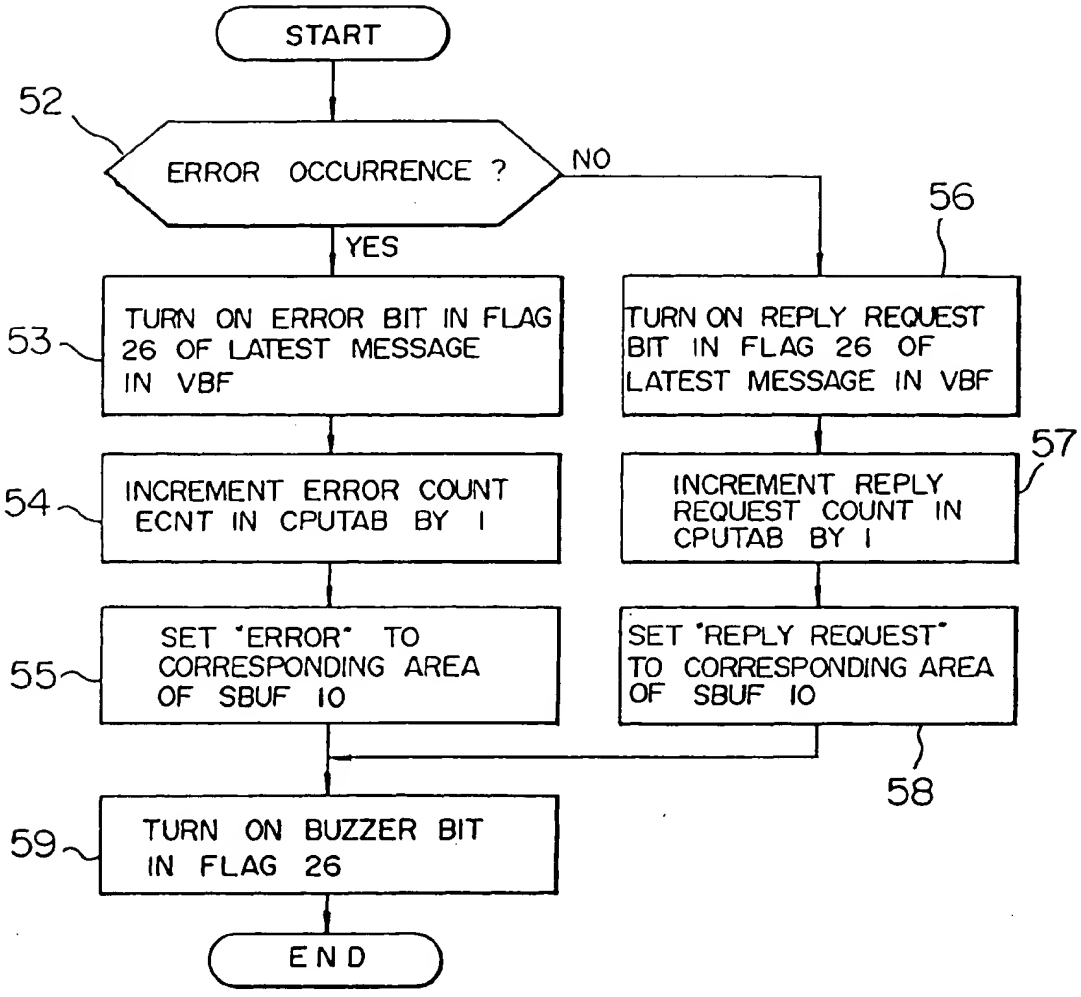

START
52
ERROR OCCURRENCE ?
NO
YES
56
53
TURN ON ERROR BIT IN FLAG 26 OF LATEST MESSAGE IN VBF
TURN ON REPLY REQUEST BIT IN FLAG 26 OF LATEST MESSAGE IN VBF
57
54
INCREMENT ERROR COUNT ECNT IN CPUTAB BY 1
INCREMENT REPLY REQUEST COUNT IN CPUTAB BY 1
55
SET "ERROR" TO CORRESPONDING AREA OF SBUF 10
SET "REPLY REQUEST" TO CORRESPONDING AREA OF SBUF 10
58
59
TURN ON BUZZER BIT IN FLAG 26
END

FIG. 9

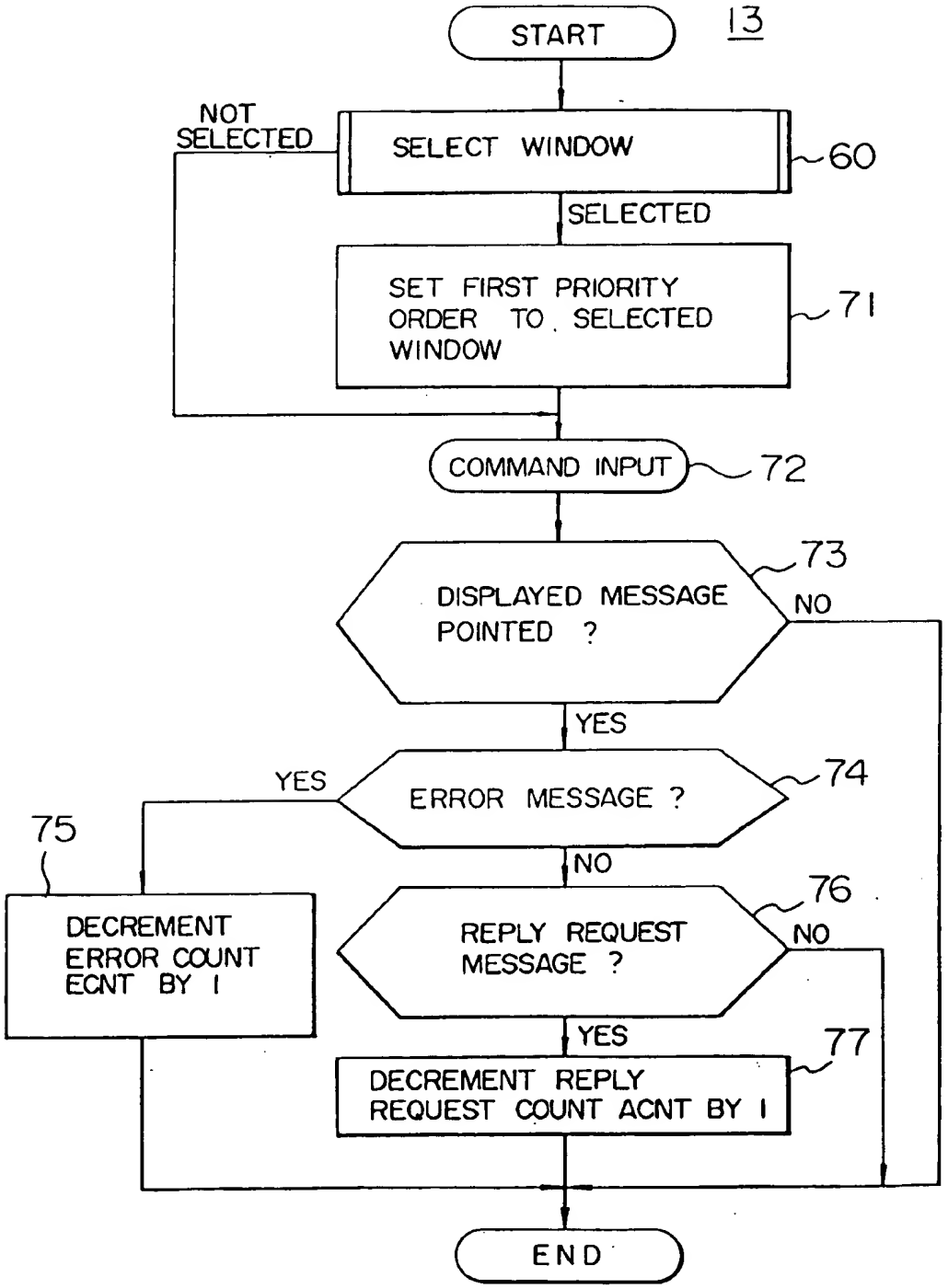

START
13
NOT SELECTED
SELECT WINDOW
60
SELECTED
SET FIRST PRIORITY ORDER TO SELECTED WINDOW
71
COMMAND INPUT
72
DISPLAYED MESSAGE POINTED ?
73
NO
YES
YES
ERROR MESSAGE ?
74
75
NO
DECREMENT ERROR COUNT ECNT BY 1
REPLY REQUEST MESSAGE ?
76
NO
YES
DECREMENT REPLY REQUEST COUNT ACNT BY 1
77
END

FIG. 10

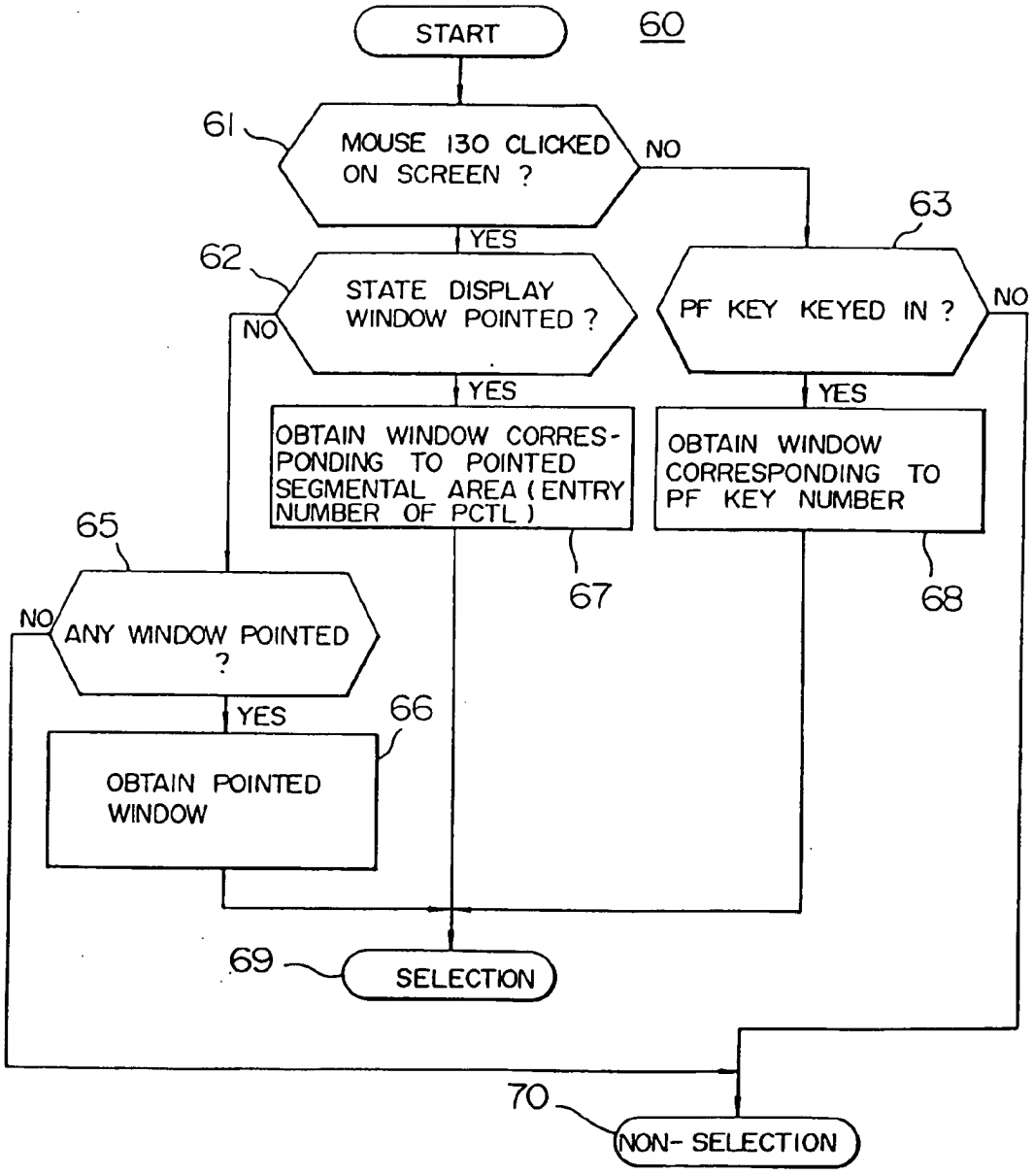

START
60
61
MOUSE 130 CLICKED ON SCREEN ?
NO
YES
62
STATE DISPLAY WINDOW POINTED ?
NO
YES
63
PF KEY KEYED IN ?
NO
YES
OBTAIN WINDOW CORRESPONDING TO POINTED SEGMENTAL AREA (ENTRY NUMBER OF PCTL)
67
OBTAIN WINDOW CORRESPONDING TO PF KEY NUMBER
68
65
NO
ANY WINDOW POINTED ?
YES
66
OBTAIN POINTED WINDOW
69
SELECTION
70
NON-SELECTION

FIG. 11

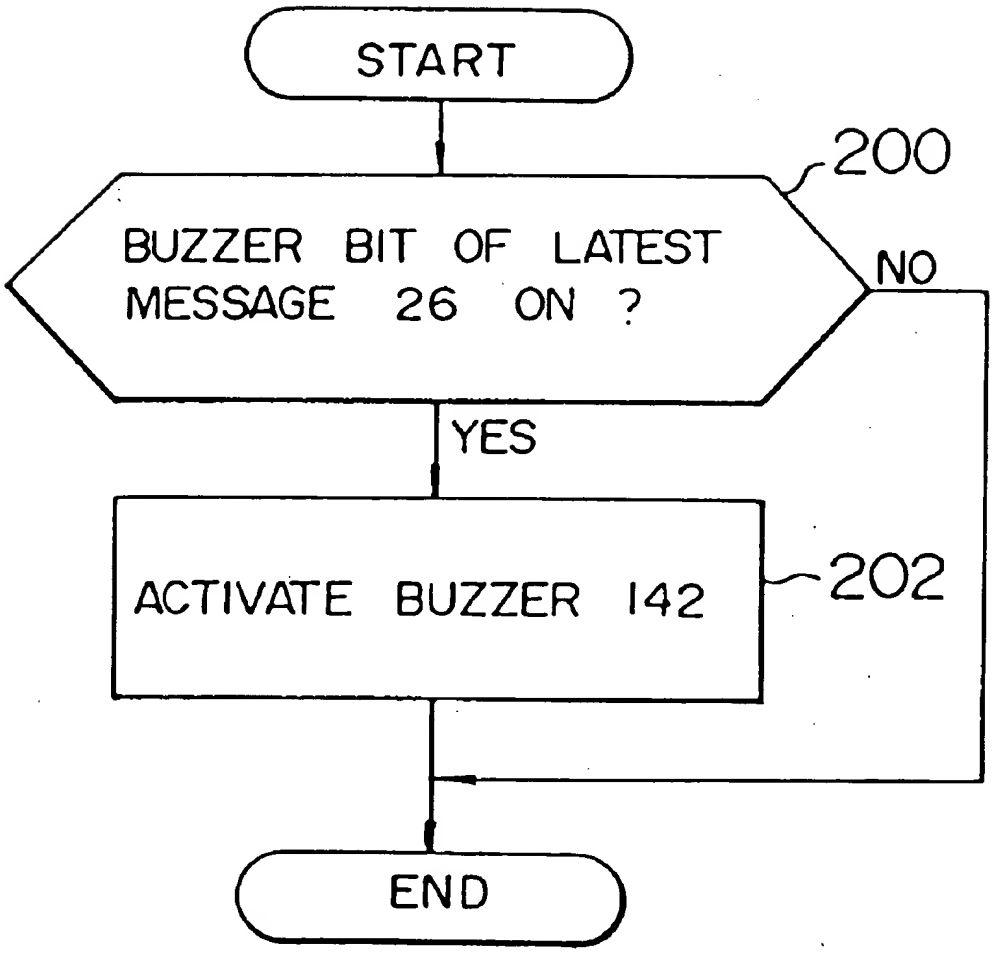

START
200
BUZZER BIT OF LATEST MESSAGE 26 ON ?
NO
YES
ACTIVATE BUZZER 142
202
END

FIG. 12A

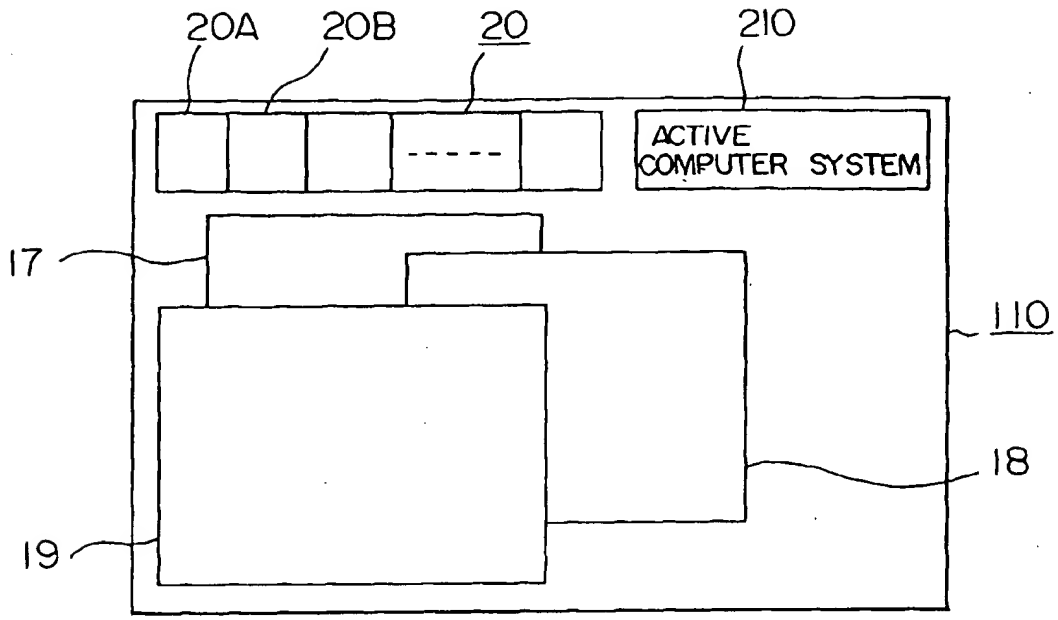


FIG. 12B

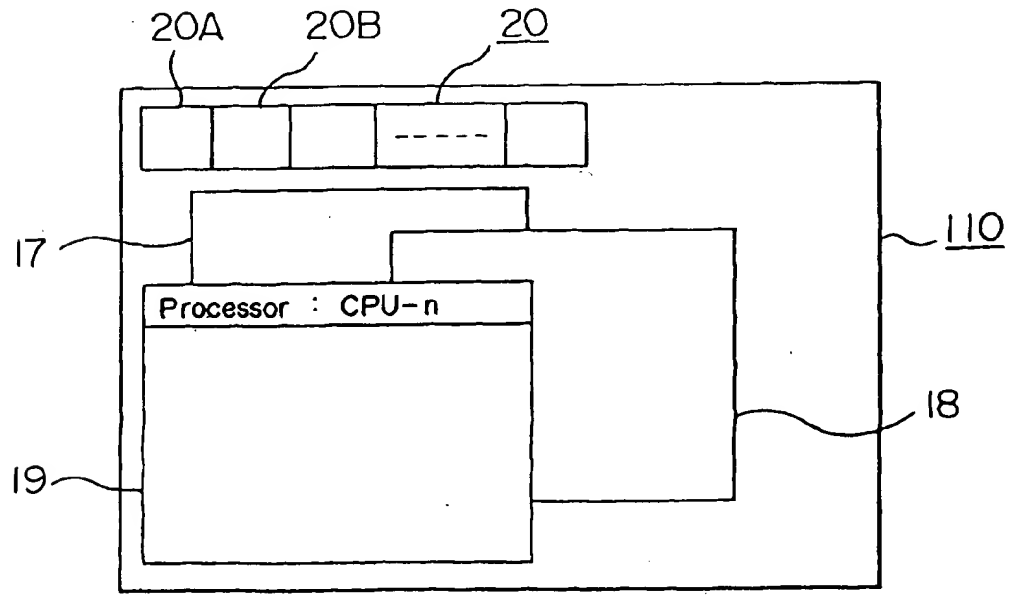
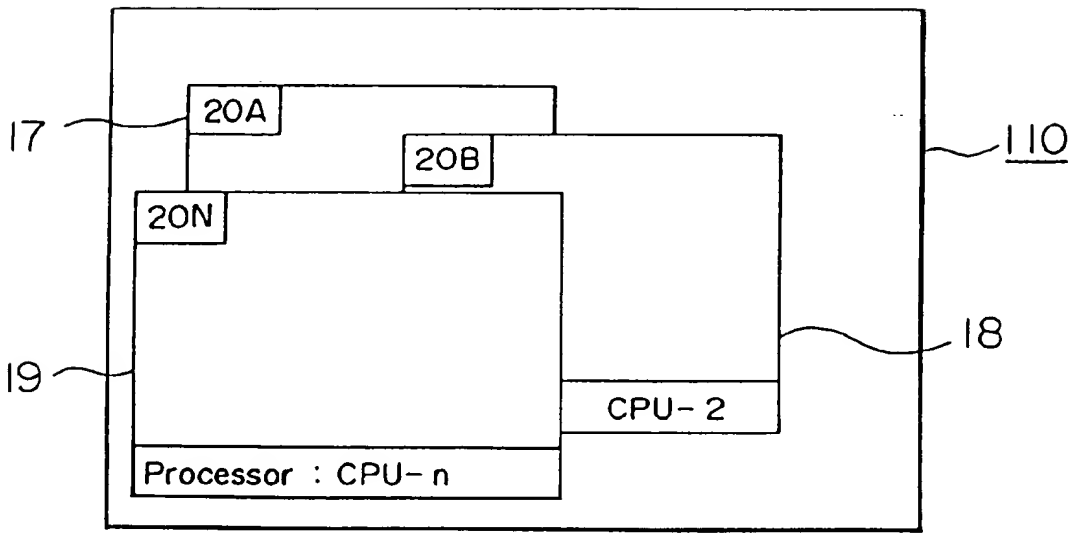


FIG. 13



CONSOLE APPARATUS FOR INFORMATION PROCESSING SYSTEM

This application is a Continuation of application Ser. No. 07/942,811, filed Sep. 10, 1992, U.S. Pat. No. 5,687,313 which is a Continuation-in-Part of application Ser. No. 07/848,930 filed on Mar. 10, 1992 abandoned.

BACKGROUND OF THE INVENTION

This application is a continuation-in-part of co-pending U.S. patent application Ser. No. 848,930 entitled CONSOLE EQUIPMENT FOR INFORMATION PROCESSING SYSTEM filed on Mar. 10, 1992 in the name of A. Ueoka et al, the contents of which are incorporated herein by reference.

1. Field of the Invention

The present invention relates to a console apparatus for an information processing system, and more particularly to a console apparatus for an information processing system capable of controlling a plurality of computer systems.

2. Description of the Related Art

As the range of applications to recent computer systems (information processing apparatuses) expands, a computer center with only one computer system is unable to meet user demands, and so a plurality of computer systems are installed at the center.

In such a case, console apparatuses numbering as many as the number of computer systems are installed. A control panel having lamps for indicating the operation state (such as error occurrence) of each computer is also provided and connected to the computer systems via private lines.

Installation of a plurality of console apparatuses forces an operator to patrol console apparatuses and periodically monitor the control panel, or requires an increase in the number of operators.

The former requirement leads to poor efficiency in operation management of computer systems and low reliability is also caused due to a possible check miss by an operator. The latter requirement is contradictory with labor savings systems.

Under such circumstances, a console apparatus capable of controlling a plurality of computer systems has been proposed, as described in Document (1) "Automatic Operation Support System by Personal Computer (V)—Console operation with Multi-window feature", Preprints of Lectures, pp.4–75, 76, the 42 (the first half year of 1991) National Conference of Information Processing Society of Japan.

According to Document (1) "Multiwindow-base Concentrated Console Function", a console function for a plurality of computer systems is realized by a single console apparatus by displaying a plurality of windows having the same number as that of the computer systems on the common screen of the console apparatus. An error display window is also given on this common screen to indicate a computer system which has any trouble.

Also disclosed in JP-A-1-96725 (Document (2)) is a console apparatus capable of controlling a plurality of computer systems of an information processing system, and displaying the operation state of each computer system on a window assigned to the computer system.

The console apparatus of a conventional information processing system disclosed in Document (2) displays both normal operation messages and abnormal operation or error messages as they occur, the error message being displayed in red. An operator is forced to always monitor the console apparatus so as not to overlook the display of a red error message.

It is necessary for an operator to respond quickly to a reply request message from a computer system, and to always monitor the status of all computer systems.

However, the "Multiwindow-base Concentrated Console Function" in Documents (1) and (2) does not disclose a means of responding to a reply request message. Although an identification of a computer system which has any trouble is indicated on the console screen, the status of other computer systems are not displayed.

Furthermore, in a conventional console apparatus, a window is not provided with an indication of to which computer system it belongs.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a console apparatus for an information processing system capable of eliminating the above-described disadvantages of the conventional techniques.

It is another object of the present invention to provide a console apparatus for an information system capable of controlling a plurality of computer systems, responding to a reply request message, and displaying the status of at least one computer system so as to facilitate recognition of it at a glance.

It is a further object of the present invention to provide a console apparatus for an information system capable of explicitly indicating for which computer system an entered command is valid.

It is a still further object of the present invention to provide a console apparatus for an information system capable of explicitly indicating for which computer system an entered command is valid.

It is a still further object of the present invention to provide a console apparatus for an information system capable of explicitly indicating to which computer system a window on the console screen corresponds.

According to an aspect of the present invention, there is provided a console apparatus for an information processing system having a plurality of information processing apparatuses, a memory for storing messages received from the plurality of information processing apparatuses, a memory being disposed at a plurality of storage areas provided in correspondence with the plurality of information processing apparatuses; a message analyzing unit for analyzing the received messages to detect, as the status of the plurality of information processing apparatuses, a reply request by the information processing apparatus to an operator and an error occurrence of the information processing apparatus; and a display unit having a shared display screen for displaying the messages stored in the memory on the shared display screen at areas corresponding to the storage areas, and for displaying among the status detected by the message analyzing unit the status of at least one information processing apparatus on the shared display screen so as to allow a recognition of the status at a glance.

According to another aspect of the present invention, there is provided a console apparatus for an information processing system having a plurality of information processing apparatuses, including a first memory for storing messages received from the plurality of information processing apparatuses, the first memory being disposed at a plurality of storage areas provided in correspondence with the plurality of information processing apparatuses; a message analyzing unit for analyzing the received messages to detect, as the status of the plurality of information process-

ing apparatuses, a reply request by the information processing apparatus to an operator and an error occurrence of the information processing apparatus; a second memory for storing the status of the plurality of information processing apparatuses detected by the message analyzing unit; and a display unit having a shared display screen for displaying the messages stored in the first memory on the shared display screen at areas corresponding to the storage areas and for displaying among the status stored in the second memory the status of at least one information processing apparatus on the shared display screen so as to allow a recognition of the status at a glance.

According to a further aspect of the present invention, there is provided a console apparatus for an information processing system having a plurality of information processing apparatuses, including a memory means for storing messages received from the plurality of information processing apparatuses, the memory being disposed at a plurality of storage areas provided in correspondence with the plurality of information processing apparatuses; a message analyzing unit for analyzing the received messages to detect, as the status of the plurality of information processing apparatuses, a reply request by the information processing apparatus to an operator and an error occurrence of the information processing apparatus; a display unit having a shared display screen for displaying the messages stored in the memory on the shared display screen at areas corresponding to the storage areas, and for displaying among the status detected by the message analyzing unit the state of at least one information processing apparatus on the shared display screen so as to allow a recognition of the state at a glance; a command input unit for inputting a command; a selecting unit for selecting the information processing apparatus to which the input command is destined; and a command storage unit for making the input command store in the memory at the storage area corresponding to the selected information processing apparatus, wherein the display unit displays the command stored in the memory and the message of the selected information apparatus stored in the memory, on the shared display screen at an area corresponding to the selected information processing apparatus.

According to a still further aspect of the present invention, there is provided a console apparatus for an information processing system having a plurality of information processing apparatuses, including a memory for storing messages received from the plurality of information processing apparatuses, the memory being disposed at a plurality of storage areas provided in correspondence with the plurality of information processing apparatuses, and a display unit having a shared display screen for displaying the messages stored in the memory on the shared display screen at areas corresponding to the storage areas and for displaying identification information of at least the information processing apparatus corresponding to the window as a foremost window on the shared display screen, on the shared display screen.

Preferably, the display unit displays the status of all the plurality of information processing apparatuses on the shared display screen so as to allow recognition of the status a glance.

Preferably, the display unit displays the status of the plurality of information processing apparatuses on the shared display screen within a common window.

According to an example of the console apparatus of the present invention, a received message is analyzed by the message analyzing unit to detect a reply request. The display unit displays the operation state such as an error occurrence, reply request, operating status and the like of at least one computer system (information processing apparatus) on the shared display screen so as to provide a recognition of the status at a glance.

At this time, an operator can know at once that there is a computer system requesting an operator response. Furthermore, with a provision of a recognition of the status of all of the computer systems at a glance, the operator can monitor the status of all of the computer systems without directly overseeing them.

According to an example of the present invention, the display unit displays the received messages on the shared display screen within windows provided in correspondence with the plurality of computer systems, and displays the operation states such as an error occurrence, reply response, operating status and the like of all of the computer systems on the shared display screen so as to provide a recognition of the status at a glance.

According to an example of the present invention, the display unit positions the window corresponding to the computer system to which an input command is destined, as the foremost window on the screen. More preferably, the display unit displays identification information representing which computer system corresponds to the foremost window.

Since the window for the input command is displayed as the foremost window on the shared display screen, it is possible to avoid an operator manipulation error. Furthermore, since the identification information is displayed, it is possible to recognize for which computer system the input command is valid.

According to another example of the present invention, the display unit displays the identification information of at least the foremost window on the shared display screen, it is possible to readily recognize which computer system corresponds to the message and the like within the window, to thereby avoid erroneous manipulation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an information processing system having a console apparatus according to an embodiment of the present invention;

FIG. 2 is a diagram showing an example of displayed images on the screen of the console apparatus of the embodiment shown in FIG. 1;

FIG. 3 is a diagram showing an example of segmented areas of the state display window shown in FIG. 2;

FIG. 4 shows a layout of keys on the keyboard shown in FIG. 1;

FIG. 5 shows the configuration of main parts of the console apparatus, for explaining the operation of the console apparatus shown in FIG. 1;

FIG. 6 shows control tables used by the console apparatus, for explaining the operation of the console apparatus shown in FIG. 1;

FIG. 7 is a flow chart explaining the operations of detecting an error message or a reply request message by the console processing unit shown in FIG. 1;

FIG. 8 is a flow chart explaining the operation of the status processing unit shown in FIG. 1;

FIG. 9 is a flow chart explaining the operation of the keyboard/mouse input processing unit shown in FIG. 1;

FIG. 10 is a flow chart explaining the operation of the window selection processing unit shown in FIG. 1;

FIG. **11** is a flow chart explaining the operation of the buzzer processing unit shown in FIG. **1**;

FIGS. **12A** and **12B** are diagrams showing examples of displayed images on the screens of console apparatuses according to other embodiments of the present invention; and

FIG. **13** is a diagram showing an example of displayed images on the screen of a console apparatus according to another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of a console apparatus for an information processing system according to the present invention will be described with reference to FIGS. **1** to **11**.

FIG. **1** is a block diagram showing the configuration of an information processing system having a console apparatus for an information processing system according to the present invention, which console apparatus can, by itself, perform collective management and control of the console function of an information processing system.

The information processing system shown in FIG. **1** has a plurality of computer systems (or information processing apparatuses), e.g., n (n is a positive integer) computer systems.

Operating systems (OSs) **211**, **212**, . . . , **21**n run on the computer systems (information processing systems) **201**, **202**, . . . , **20**n. Application programs (APs) run on these OSs **211**, **212**, . . . , **21**n which may be the same OS or different OSs.

Each computer system **201**, **202**, . . . , **20**n is connected via each corresponding terminal control equipment (TCE) **221**, **222**, . . . , **22**n to a console apparatus controller **100**. Each TCE is connectable to a plurality of terminal equipments. At least one signal line among a plurality of signal lines of each TCE is used for the connection to the console apparatus. These signal lines are represented by L1, L2, . . . , Ln in the example shown in FIG. **1**.

Messages and commands are transferred to and from service processors (SVPs, not shown) of the computer systems **201**, **202**, . . . , **20**n via the signal lines L1, L2, . . . , Ln.

With the conventional technique, a console apparatus to be provided independently for each computer system is connected to each of the signal lines L1, L2, . . . , Ln. According to this embodiment, however, a single console apparatus by itself performs collective management and control of the console function of the information processing system. The console apparatus is constructed of, e.g., the controller **100**, a display unit **110**, a keyboard **120**, and a mouse **130**. This single console apparatus is adapted to control a plurality of computer systems. The controller **100** is provided with a data processing capability, and may be realized by using a personal computer or work station. OS such as MS-DOS and UNIX (both registered trademarks) run on this controller **100**, such OSs being omitted in FIG. **1**. The controller **100** is connected not only to the display unit **110**, but also to the input devices including the keyboard **120** and mouse **130**.

In the controller **100**, various processing units or program sets operate to perform collective management and control of the console function of the information processing system according to the present invention. Reference numeral **1** represents a communication processing unit which controls the transfer of messages and commands between the computer systems **201**, **202**, . . . , **20**n and OSs **211**, **212**, . . . , **21**n. The communication processing unit **1** has a function of controlling the data transfer to and from each of the signal lines L1, L2, . . . , Ln. For example, it has a function of a virtual telecommunication access method (VTAM) which is described in the following documents:

(1) IBM Systems Journal, Vol. 15, No. 1, pp. 4 to 80, 1976; and

(2) IBM Systems Journal, Vol. 13, No. 2, pp. 140 to 162, 1974, "Synchronous data link control: A perspective".

Reference numerals **101**, **102**, . . . , **10**n represent console processing units (CPUs) for respective computer systems **201**, **202**, . . . , **20**n, for realizing the function of the console apparatus. The console processing unit **101** is provided for the computer system **201**, the unit **102** for the system **202**, . . . , and the unit **10**n for the system **20**n. The console processing units **101**, **102**, . . . , **10**n are labeled in FIG. **1** CPU_1, CPU_2, . . . , CPU_n, respectively. The number of computer systems may be set as desired according to the present invention.

Each console processing unit **101**, **102**, . . . , **10**n of the controller **100** can send a command for an initial program load (IPL) and commands for the hardware control to the service processor of each computer system **201**, **202**, . . . , **20**n. Each console processing unit can receive a hardware error message from each service processor.

Reference numerals **111**, **112**, . . . , **11**n represent virtual display buffers labeled in FIG. **1** VBF_1, VBF_2, . . . , VBF_n for the respective CPU_1, CPU_2, . . . , CPU_n. Reference numeral **122** represents an identification (ID) table for storing identification information CPU-**1**, CPU-**2**, . . . , CPU-n of the computer systems **201**, **202**, . . . , **20**n. Reference numeral **8** represents a message management table (MTAB) for storing error messages and reply request messages. Reference numeral **9** represents a state processing unit. Reference numeral **10** represents a state virtual display buffer (SBUF).

The state virtual display buffer **10** is divided into segmental areas (**10A**, **10B**, . . . shown in FIG. **5**) corresponding to the computer systems **201**, **202**, . . . , **20**n. Reference numeral **11** represents a real display buffer. Reference numeral **12** represents a display processing unit for the control of the display unit **110**. Reference numeral **13** represents keyboard/mouse input processing unit, and reference numeral **14** represents a keyboard input data destination processing unit.

Reference numeral **14A** represents an identification information table (TCPU) for storing identification information for identifying a computer system regarding to which a command input via the keyboard/mouse input processing unit **13** is transferred, and reference numeral **15** represents a keyboard input buffer (KEYB).

Reference numeral **16** represents a history file for storing messages sent from the console processing units **101**, **102**, . . . , **10**n while discriminating the messages among the console processing units.

FIG. **2** shows an example of images displayed on the screen of the display unit shown in FIG. **1**.

Reference numerals **17**, **18**, **19**, . . . represent windows. The window **17** is provided for the computer system **201**, the window **18** for the computer system **202**, . . . , and the window **19** for the computer system **20**n.

Reference numerals **17A**, **18A**, **19A**, . . . represent identification display areas for displaying identification information representative of the correspondence between windows **17**, **18**, **19**, . . . and the computer systems. It is possible to easily and correctly recognize, from the displayed identification information, which window belongs to which computer system.

Reference numeral **20** represents a state display window for displaying various states of the computer systems **201, 202, . . . , 20n**. This window **20** is divided into segmental areas **20A, 20B, 20C, . . . , 20n** corresponding to the computer systems **201, 202, . . . , 20n**.

Of the segmental areas **20A, 20B, 20C, . . . , 20n**, the segmental area **20A** for example has four sub-areas as illustratively shown in FIG. **3**, including an identification display sub-area **21**, an under-operation display sub-area **22**, an error display sub-area **23**, and a reply request display sub-area **24**.

Displayed on the identification display sub-area **21** within each segmental area is the identification information (e.g., CPU-**1**, . . . , CPU-n) of the computer system corresponding to the segmental area. Displayed on the under-operation display sub-area **22** for the computer system with no error occurrence and no reply request issuance, is the operation state information of "Under-operation". If the computer system is at a stop, an indication "Stop" may be displayed on the under-operation display sub-area **22**, or alternatively no indication is displayed. Displayed on the error display sub-area **23** for the computer system with an error occurring thereat, is the operation state information of "Error". Displayed on the reply request display sub-area **24** for the computer system requesting an operator response, is the operation state information of "Reply request". The sub-areas displaying "Error" and "Reply request" are preferably indicated in a different color from that of the other sub-areas. If there is a sub-area displaying "Error" or "Reply request", a buzzer for example provided at the controller **100** is activated to generate an alarm sound, as will be described later.

The states of all of the computer systems **201, 202, . . . , 20n** can be recognized at a glance from the state display window **20**, and an alarm sound from the buzzer can help an operator take necessary action.

FIG. **4** shows an example of the layout of keys of the keyboard **120**.

Reference numeral **120A** represents a special key group (program function keys P•F keys), and reference numeral **120B** represents a general key group.

Special keys PF**1**, PF**2**, . . . , PFn of the special key group **120A** are assigned to the computer systems **201, 202, . . . , 20n**.

The functions of the above-described processing units **1**, **101** to **10n**, **9**, **12** to **14** may be implemented by hardwares or by using a microprocessor and programs. In the latter case, each of these units has the program for performing the function thereof and these programs are operated by the microprocessor.

Next, the operation of the console apparatus of the embodiment will be described with reference to FIGS. **1** and **5**.

As shown in FIG. **5**, when the communication processing unit **1** receives a message **25** from one of the computer systems, the control is passed to the corresponding one of the console processing units **101, 102, . . . , 10n**. In the following, the control at the console processing unit **101** for the computer system **201** for example will be described.

The console processing unit **101** stores the received message in the associated virtual display buffer **111**, and in the message history file **16** as the history of messages.

The console processing unit **101** checks whether the message **25** is an error message indicating an error occurrence, a reply request message requesting an operator response, or another message.

The message **25** is judged to be an error message for example, from one of the following judgment criteria:

(1) A display code field **25A** of the message **25** contains a turned-on or set error flag.

(2) A message field **25B** of the message **25** has the same contents as an error message stored in the message management table **8**.

(3) A special character or symbol representing an error occurrence exists at a particular position of the message field **25B** of the message **25**. For example, the message **25** contains a symbol "@" at the start thereof.

The message **25** is judged to be the reply request message for example, from one of the following criteria:

(1) The display code field **25A** of the message **25** contains a turned-on or set reply request flag.

(2) The message field **25B** of the message **25** has the same contents as a reply request message stored in the message management table **8**.

(3) A special character or symbol representing a reply request exists at a particular position of the message field **25B** of the message **25**. For example, the message **25** contains a symbol "*" at the start of it.

If one of the above criteria is satisfied, it is judged that the received message **25** is the error message or reply request message, and control is passed to the state processing unit **9**. In the following description, it is assumed that the received message **25** is an error message, and the control is passed to the state processing unit **9**.

The error flag in a message is turned on by a service processor or OS of a computer system when it detects an error. On the other hand, error messages in the table MTAB **8** are those entered in advance by an operator using the input device such as the keyboard. Judgment of an error message may be made by using only the error flag without using the table **8**.

The state processing unit **9** stores the state information of "Error" or "Reply request" in one of segmental areas **10A, 10B, . . . , 10n** of the state virtual display buffer **10** corresponding to one of the computer systems **201, 202, . . . , 20n** from which the message was sent. For example, the state information of "Error" is stored in the segmental area **10A** of the state virtual display buffer **10** corresponding to the computer system **201**.

The state processing unit **9** also turns on an error bit or reply request bit of a flag in one of the virtual display buffers **111, 112, . . . , 11n** corresponding to one of the computer systems **201, 202, . . . , 20n** from which the message **25** was sent. For example, the error bit of the flag **26** is turned on in the virtual display buffer **111** corresponding to the computer system **201** from which the message **25** was sent. The state processing unit **9** reads from an identification (ID) table **122** the identification information of the computer system having issued the message, adds the identification information to the state information of the message to store them in the state virtual display buffer **10**.

In the above manner, messages from the computer systems **201** to **20n** are stored in the corresponding virtual display buffers **111** to **11n** (VBF_1 to VBF_n), and the state information of the messages together with the identification information is stored in the state virtual display buffer SBUF **10**. Next, the display processing unit **12** shown in FIG. **1** operates so as to transfer the contents of the virtual display buffers **111** to **11n** (VBF_1 to VBF_n) and state virtual display buffer SBUF **10** to the real display buffer **11** in accordance with a multiwindow display procedure. The display processing unit **12** is always operating.

Specifically, this unit **12** reads the messages from the virtual display buffers **111** to **11n** and transfers them to the real display buffer **11**, and also reads the state information

and identification information from the state virtual display buffer **10** and transfers them to the real display buffer **11**. The display processing unit **12** may read the identification information directly from the ID table **122**. The display processing unit **12** operates to display the contents of the real display buffer **11** on the screen of the display unit **110**, while referring to a priority table **41** and window management tables **42-1**, . . . , **42**-n and **44** to be described later.

Messages and the like are therefore displayed on the screen of the display unit **110** within the windows **17, 18, 19**, . . . and state display window **20**, as illustratively shown in FIGS. **2** and **3**. The window mapping procedure by the display processing unit **12** from the virtual display buffers VBF_1 to VBF_n to the real display buffer **11** may be conducted following the technique disclosed in U.S. Pat. No. 4,550,386, JP-A-60-135989 and JP-A-62-6377 of the same assignee of the present application.

FIG. **6** shows the relationship between control tables to be used for the display control. These control tables are provided within the controller **100**. The priority management table (PCTL) **41** stores the display priority order of the windows **17, 18, 19**, . . . and state display window **20**, the display priority order meaning the order of windows to be displayed on the screen starting from the foremost window on the screen and following windows sequentially displayed in the background.

The priority management table PCTL **41** stores the number **41***a* of entries (corresponding to the number n of computer systems), the priority order **41***c* of the windows, the addresses **41***d* (e.g., W1, . . . , Wn) of the window management tables **42-1**, . . . , **42**-n for the windows **17, 18, 19**, . . . , and the address **41***f* (e.g., S1) of the state display window management table **44** for the state display window **20**. The priority order of these windows is entered, for example, from the mouse **130** via the keyboard **120** and keyboard/mouth input processing unit **13**.

Each window management table CPUTAB **42-2** to **42**-n has the same structure. For example, the window management table CPUTAB1 **42-1** has a field **42***a* for storing the identification information of the computer system **201**, and stores start and end point coordinates **42***b* and **42***c* of the window for the computer system **201**, an error count **42***d*, a reply request count **42***e*, the address **42***f* of the associated virtual display buffer **111**, and the entry number **42***g* of the priority management table **41**.

As will be detailed later, the error count ECNT **42***d* and reply request count ACNT **42***e* are incremented by 1, for example, each time an error message or reply request message is detected in the message from the corresponding computer system, and decremented by 1, for example, each time an operator has dealt with the received message.

The start and end point coordinates of each window are entered, for example, from the mouse **130** via the keyboard **120** and keyboard/mouth input processing unit **13**.

The state display window management table **44** stores the start and end point coordinates **44***b* and **44***c* of the state display window **20**, the address **44***d* of the state virtual display buffer **10**, and the entry number of the priority management table **41**, as well as the start and end point coordinate set of the segmental areas **20**A to **20**N of the state display window **20**.

In order to display the state display window **20** so as not to be covered by the other windows **17, 18, 19**, . . . , the priority order of the window **20** is set to the most preferential order in the priority order management table **20** (in this case, the state display window **20** is displayed as the foremost window on the screen), or the start and end point coordinates **44***b* and **44***c* of the state display window management table **44** are set to values which allow the state display window **20** not to be covered by the other windows **17, 18, 19**, ...

In displaying the contents of the real display buffer **11**, the display processing unit **12** refers to the priority orders stored in the table **41**, the coordinates of the windows stored in the tables **44**, **42-1** to **42**-n.

Next, a command input operation will be described.

When a message "Reply request" is displayed on the state display window **20**, it is necessary to send a command to the computer system which issued the reply request message.

If a command is to be sent to a computer system, an operator is required to select the computer system. This selection may be made by one of the following three schemes:

(1) One of the windows **17, 18, 19**, . . . , displayed on the screen corresponding to the subject computer system is pointed by using a pointing device such as the mouse **130**.

(2) One of the segmental areas **20**A, **20**B, . . . , **20**n of the state display window **20** displayed on the screen corresponding to the subject computer system is pointed by using a pointing device such as the mouse **130**.

(3) One of the special keys **120**A on the keyboard **120** corresponding to the subject computer system is keyed in.

When an operator selects the subject computer system to which a command is sent, using one of the three schemes, the display processing unit **12** renews the contents of the VBF for the window stored in the real display buffer **11** so that the window is displayed as a foremost window on the screen. The identification information of the subject computer system is read from the ID table **122** and stored in the identification information table TCPU **14**A. In addition, the priority order of the subject computer system is updated to the most preferential order in the priority management table **41**.

Next, the operator enters a command from the keyboard **120**.

The keyboard/mouse input processing unit **13** stores the command entered from the keyboard **120** in the keyboard input buffer **15**.

The display processing unit **12** displays the command stored in the keyboard input buffer **15** on the window for the object computer system, this window being displayed as a foremost window on the screen. In this manner, the input command is displayed on the foremost window on the screen.

The keyboard input destination processing unit **14** stores the command entered from the keyboard **120** in the virtual display buffer VBF for the computer system identified by the identification information stored in the identification information table **14**A.

The command stored in the virtual display buffer is transmitted to the subject computer system, by means of one of the console processing units **101**, . . . , **10**n and communication processing unit **1**.

Next, referring to FIG. **7**, the operation of each console processing unit **101** to **10**n in detecting an error message or a reply request message will be described in detail. In the following, the operation of the console processing unit **101** for example will be described, the operation of the other console units **102** to **10**n being the same as that of the console processing unit **101**.

At step **31**, the console processing unit **101** receives a message **25** from the communication processing unit **1**.

At step **32**, the received message **25** is stored in the virtual display buffer **111** (VBF_1).

At step **33**, the display code field **25**A of the message **25** is checked to determine whether the error flag is on, the reply

request flag is on, or neither flag is on. If the error flag or reply request flag is on, the control is passed to the state processing unit **9**. If both the flags are not on, the control advances to step **34**.

At step **34**, the message management table **8** is searched to check whether the same message as the message **25** in the message field **25**B is being stored in the table **8**.

At step **35**, if the same message as the message **25** in the message field **25**B is being stored in the message management table **8**, control is passed to the state processing unit **9**. If not, control advances to step **36**.

At the step **36**, the message field **25**B is checked to determine whether a special symbol (e.g., a symbol "@" representing an error occurrence or a symbol "*" representing a reply request) exists at a particular position (e.g., the top of the message). If one of these special symbols exists at the particular position, control is passed to the state processing unit **9**. If none of these symbols exists at the particular position, the process is terminated. When control is passed to the state processing unit **9** from each of the steps **33**, **35**, and **36**, a code representing the type of message is sent to the state processing unit **9** as a control parameter.

Next, the operation of the state processing unit **9** will be described in detail with reference to FIG. **9**.

At step **52**, the state processing unit **9** judges, from the code representing the type of message received from the console processing unit **101**, which of the error message and the reply request message was detected. If it is judged that the error message was detected, control advances to step **53**. If it is judged that the reply request message was detected, control advances to step **56**. The state processing unit **9** may judge by itself the type of a message without receiving the code representing the type of message from the console processing unit.

Turned on (set) at step **53** is the error bit of the flag **26** (FIG. **5**) for the latest message stored in the virtual display buffer corresponding to the computer system from which the error message was sent.

Incremented by a certain count, e.g., 1 count at step **54** is the value of the error count **42***d* (FIG. **6**) stored in the window management table for the computer system from which the error message was sent.

At step **55**, the state information of "Error" is set to an area of the state virtual display buffer **10** for the computer system from which the error message was sent. Preferably, the display color is changed and a flushing display is instructed.

On the other hand, turned on (set) at step **56** is the reply request bit of the flag **26** (FIG. **5**) for the latest message stored in the virtual display buffer corresponding to the computer system from which the reply request message was sent.

Incremented by a certain count, e.g. 1 count at step **57** is the value of the reply request count **42***e* (FIG. **6**) stored in the window management table for the computer system from which the reply request message was sent.

At step **58**, the state information of "Reply request" is set to an area of the state virtual display buffer **10** for the computer system from which the reply request message was sent. Preferably, the display color is changed and a flushing display is instructed.

Turned on (set) at step **59** is the buzzer bit of the flag **26** (FIG. **5**) for the latest message stored in the virtual display buffer corresponding to the computer system from which the error message or reply request message was sent.

Next, the operation of activating the buzzer **142** will be described with reference to FIG. **11**. In displaying the windows for the computer systems, the display processing unit **12** checks at step **200** whether there is a turned-on buzzer bit in any one of the virtual display buffers VBF_1 to VBF_n. If there is no turned-on buzzer bit, the buzzer is not activated. If there is a turned-on buzzer bit, the display processing unit **12** instructs the buzzer processing unit **140** to activate the buzzer for a predetermined period, e.g., 3 seconds at step **202**.

Next, the operation of the keyboard/mouse input processing unit **13** will be detailed with reference to FIGS. **9** and **10**.

At step **60**, the control is passed to a window selection processing unit **60** within the keyboard/mouse input processing unit **13**.

As shown in FIG. **10**, in the window selection processing unit **60**, it is first checked at steps **61** to **63** whether the schemes (1) to (3) for selecting a computer system described previously were performed.

Steps **65** and **66** illustrate a process of pointing a window for a particular computer system with the mouse **130**.

Step **67** illustrates a process of pointing a segmental area in the state display window **20** for a particular computer with the mouse **130**.

Step **68** illustrates a process of keying in one of the special keys **120**A.

If it is judged that a window was pointed at step **62** or step **65** or a PF key was keyed in at the step **63**, then the entry number of the pointed window stored in the priority management table **41** is located or established. Namely, obtained is a pointed window, a window corresponding to the pointed segmental area, or a window corresponding the keyed-in PF key number (steps **66**, **67**, **68**). The procedure then returns having a selected window (selection return) (step **69**).

On the other hand, if it is judged that no window was pointed at the steps **62** and **65** or that no RF key was keyed in at the step **63**, then the entry number within the table **41** cannot be located. Namely, the window selection conditions are not satisfied, and the procedure terminates as a non-selection return (step **70**).

A window pointed at the step **65** is identified by the processing unit **60** with reference to the start and end point coordinates of the windows stored in the window management tables **42**-2 to **42**-n.

A window pointed at the step **62** is identified by the processing unit **60** with reference to the start and end point coordinates of the segmental areas **20**A, **20**B, . . . , **20**N of the state display window **20** stored in the state display window management table **44**.

Returning back to FIG. **9**, the keyboard/mouse input processing unit **13** gives a most preferential order to the selected window so as to display this window as the top of windows on the screen. Specifically, the priority value **41***c* (FIG. **6**) of the entry within the priority order management table located by the window selection processing unit **60**, is given the largest number for example. The identification information of the computer system to which a command is to be sent is read from the ID table **122** and set to the identification information table **14**A.

At step **72**, when a command is input from the keyboard **120**, this command is stored in the keyboard input buffer **15** and in the corresponding virtual display buffer **111** via the keyboard input destination processing unit **14**.

The command stored in the keyboard input buffer **15** is transferred to the real display buffer **11**. The command stored in the virtual display buffer **111** is transmitted via the communication processing unit **1** to the corresponding computer system.

At step **73** it is checked whether an operator points the message or state information displayed within the state

display window **20**. This message pointing is performed, for example, by the mouse. Then, the keyboard/mouse input processing unit **13** refers to the start and end point coordinates of the segmental areas **20A** to **20N** stored in the state display management table **44**, and identifies the segmental area within which the message (error message, or reply request message) is being displayed. If no message is pointed, the procedure terminates. If anyone of the messages is pointed, the control advances to step **74**.

In this manner, after an operator recovers an error in response to the error message, or after an operator responds to the computer system in response to the reply request message, the operator points the associated message within the state display window **20**.

Specifically, at steps **74** and **75**, when an error message is pointed, the error count **42***d* in the associated window management table is decremented by 1 for example.

At steps **76** and **77**, when a reply request message is pointed, the reply request count **42***e* in the associated window management table is decremented by 1 for example.

When a message other than the error and reply request messages is pointed, the procedure terminates without performing any process.

The display processing unit **12** continues to display the error or reply request message within the segmental areas of the state display window, until the values of the error counts **42***d* or reply request counts **42***e* of the window management tables **42-1** to **42-n** become 0.

Namely, for each computer system, when all reply requests have been responded to or all errors for error messages have been recovered, its count **42***e* or **42***d* becomes 0, and the display of "Reply request" or "Error" within the segmental area of the corresponding state display window **20** disappears.

FIG. **12A** shows an example of images displayed on the screen of a display unit according to another embodiment of the present invention.

In this embodiment, the identification information of a window at the top of windows on the screen is displayed on an active computer system display window **210**. The identification information is not displayed therefore within the foremost window on the screen.

FIG. **12B** shows an example of images displayed on the screen of a display unit according to a further embodiment of the present invention, wherein the identification information is displayed only for the foremost window.

FIG. **13** shows an example of images displayed on the screen according to a still further embodiment, wherein the state display window **20** is not provided, but the indications such as the error message, reply request message, and under-operation message are displayed within each window **17**, **18**, . . . , **19**.

According to the console apparatus of the present invention, a single console apparatus can control a plurality of computer systems. The operation states such as error, reply request, under-operation or the like for all computer systems can be displayed so as to recognize them at a glance, preventing an operator from overlooking the states of computer systems.

Furthermore, a command entered by an operator is supplied to the computer system whose window is displayed as the top of windows on the screen. Therefore, which computer system is valid for an entered command can be visually recognized from the screen, preventing erroneous manipulations. Still further, the identification information of at least the computer system having the foremost displayed window is displayed on the screen, providing easy recognition of the correspondence between windows and computer systems.

In the above embodiment, an error message for a computer system may be a message which can discriminate between the types of error (e.g., error of software (OS or AP) or error of hardware). In this case, the types of errors are analyzed by the console processing unit and displayed for example on the state display window **20** on the screen.

Furthermore, instead of activating a buzzer when there occurs an error or reply request, a lamp may be illuminated. In this case, in place of the buzzer processing unit **140** and buzzer **142** shown in FIG. **1**, a lamp processing unit and a lamp are provided.

Many different embodiments of the present invention may be constructed without departing from the spirit and scope of the invention. It should be understood that the present invention is not limited to the specific embodiments described in this specification. To the contrary, the present invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the claims.

What is claimed is:

1. A console apparatus for an information processing system having a plurality of information processing apparatuses, comprising:

memory means, having a plurality of storage areas assigned to respective ones of said plurality of processing apparatuses, for storing messages received from said respective ones of said plurality of information processing apparatuses in one of said storage areas assigned thereto;

message analyzing means for analyzing said message received from one of said plurality of information processing apparatuses to detect a state of said one of said plurality of information processing apparatuses; and

display processing means, including a display screen, for displaying state identification information representing said detected states of said plurality of information processing apparatuses and information of said storage areas assigned to respective ones of said plurality of processing apparatuses on said display screen as respective windows in an overlapping multi-window form, wherein

said window for displaying said state identification information is displayed so as not to be hidden by remaining windows displayed in said overlapping multi-window form.

2. A console apparatus according to claim **1**, further comprising a priority order management table having information for setting a priority order of said window for displaying said state identification information in a preferred order, wherein said display processing means displays said window for displaying said state identification information as a foremost window on said display screen based on said information stored in said priority order management table.

3. A console apparatus according to claim **1**, further comprising a window management table having information of a start coordinate and an end coordinate of each of said respective windows which are adjustable, wherein said display processing means displays said respective windows on the basis of said information stored in said window management table so that said window for displaying said state identification information is displayed so as not to be hidden by remaining windows.

4. A console apparatus according to claim **1**, wherein said display processing means displays, at said window for displaying said state identification information, state identification information representing said detected state of at least one of said plurality of information processing apparatuses.

5. A console apparatus according to claim 1, wherein said message analyzing means detects, as said state of said one of said plurality of information processing apparatuses, at least one of an issuance of a reply request from said information processing apparatuses to an operator of said information processing system and an error occurrence of said information processing apparatuses.

6. A console apparatus according to claim 5, wherein said display processing means displays, at said window for displaying said state identification information, not only said state identification information representing said detected state of at least one of said plurality of information processing apparatuses but also identification information of said at least one of said plurality of information processing apparatuses.

7. A console apparatus according to claim 1, wherein, when one of said remaining windows displays a message received from one of said plurality of information processing apparatuses which is in a detected state shown by said window for displaying said state identification information, said display processing means displays said one of said remaining windows as a foremost window on said display screen except for said window for displaying said state identification information.

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